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Additional Details on Long March 2-E Strap-On Launch Vehicle

91P60003 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 2 Sep 90 p 1

[Editorial Report] Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese on 2 September 1990 carries on page 1 a 600-word article reprinted from a piece by reporter Sun Minqiang [1327 3046 1730] in ZHONGGUO HANGKONG HANGTIAN BAO [CHINA AEROSPACE NEWS] on the cooperation of various ministries and production units in the joint development of the new Long March 2-E (CZ 2-E or LM 2-E) heavy-thrust launch vehicle. Details not already revealed in previous reporting on this topic (see FBIS-CHI-90-173, 6 Sep 90, pp 34-36 [a reprint of BEIJING REVIEW in English, No 36, 3-9 Sep 90, pp 23-26] and JPRS-CST-90-024, 25 Sep 90, pp 3-4) are given below.

Over 20 ministries and commissions and 300 enterprises cooperated in this successful effort to develop a new type of launch vehicle in only 18 months—a feat that has astounded a prominent U.S. assistant senior rocket designer in his 70s. The project required over 7000 orders of goods and materials totaling over 2000 tons and consisting of over 580,000 individual parts. Some of the government units that responded quickly in January 1989, when the Ministry of Aeronautics & Astronautics Industry issued its materials requirements, include the State Planning Commission, the Ministry of Materials, the Ministry of Metallurgical Industry, the Ministry of Machine-Building & Electronics Industry (MMEI), the Ministry of Chemical Industry, the Ministry of Construction, the Ministry of Light Industry, the Ministry of Textile Industry, and the China National Nonferrous Metals Industry Corporation (CNNMIC). The electric-power bureau of the Ministry of Energy Resources, the Ministry of Railways, the Ministry of Communications (i.e., Transportation), and the Civil Aviation Administration also assisted at various points along the way.

Among the 300 plants that provided raw materials and components, the Southwest Aluminum Processing Plant, postponing work on a high-profit export contract, manufactured the large forged rings that go on the LM 2-E. CNNMIC's Shanghai Yayan [1090 1693] Plant carried out a thorough inspection of its smelting furnaces and conducted trial smeltings to ensure compliance with specifications before going into production. The Shenyang Cable Plant provided over 63 kilometers of cable in 41 varieties. The Harbin Transistor Plant manufactured over 3000 specialized devices in 15 varieties. Employees at MMEI's Plant 4326, during a 5-day period at Spring Festival time last year, put in 500 man-days of overtime to fulfill their contract in April [1989], 1 month ahead of schedule.

Plans For Future Satellite Launches

91FE0048A Beijing CHINA DAILY in English 26 Sep 90 p 5

[Article by Zhou Jie]

[Text] China plans to launch more satellites which will directly serve the country's social and economic development this decade, a senior space official said this week.

Qi Faren, Vice-President of the Chinese Academy of Space Technology (Cast), said, "Satellites have brought many benefits in communications, meteorology and the detection of natural resources.

"More and more fields are looking to make use of them, so this decade, we will work on developing and launching satellites with badly-needed applications, such as large capacity communication satellites, earth resource remote sensing satellites, meteorological satellites, navigation satellites and ocean survey satellites."

Qi, who is also chief director of China's communication satellites, attributed the make-up of the country's space industry to its economic situation. "We cannot expect more money to be put into the space industry at present," he said.

"We will continue to probe space and improve our technology. But at present we have to concentrate on what is most needed," he said. But he added that outer space probes, space shuttles and space stations were among China's aims in the future.

He said China, using its own strengths, had made great achievements in the space industry in the past 20 years. However, "they are a long way from satisfying the country's growing needs."

The country has three communications satellites and one weather satellite in orbit now, but the United States and the Soviet Union both have dozens of sateilites, according to Qi.

He said China was working on Dongfanghong 3 (The East Is Red III) large capacity telecommunications satellites and its carrier Long March 3A, a geostationary weather satellite, and an earth resource sensing satellite. The three satellites are scheduled to be launched in 1993 or later.

Space Programme

Qi said China still aimed to send its own astronauts into space.

China had also been closely following world developments in space medical research and had conducted various important experiments and studies with the aim of sending Chinese astronauts into space some time in the future, according to a recent report by Wei Jinhe, president of the Space Medical Engineering Institute.

A number of so-called "space trainees" are currently being trained and experimented on in the institute, which is said to be the "cradle of China's astronauts."

The institute was conducting tests on life support systems, including spacesuits, for space travel, and on human reaction to weightlessness, Wei said.

Some foreign experts said after visiting the institute that China had the ability to send astronauts to space as far as space medical research was concerned.

Problems

But Qi said that China's space industry now faced some major problems. One of them, which affects much of Chinese industry, is lack of money.

"The space industry requires large investment. However, its output outweighs the input," said Qi.

He declined to reveal the exact level of China's investment in its space industry, but indicated that it was much less than India or Brazil.

It is reported that in 1986 India spend about $250 million on space development.

Qi described the situation as "spending money on a coffin for a patient without spending money on medicine."

He said China spent more than 50 billion yuan ($10.6 billion) annually on natural disaster rescue. "Why not take one tenth of that money for research in weather satellites which will forecast natural disasters and reduce the losses?" he said.

"At any rate, we did the best work with the little money we had," Qi said proudly.

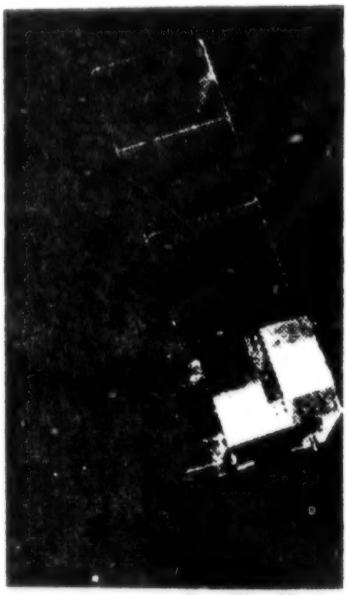
A second problem was the low standard of China's basic machinery and electronic industries, according to Qi.

Basic parts which were too big, too heavy and had a short lifespan meant China's previous satellites lasted only about 5 years, compared with more than 10 years in the United States and the Soviet Union.

But what was most troubling to Qi was the loss of trained professionals.

"Many of our institute's scientists have gone abroad or moved to companies where they have a higher salary," Qi complained. "And others are thinking of leaving."

Although these problems might last for some time, China had weathered many more difficulties in the past 20 years to place itself among the world's space superpowers, Qi concluded.



Earth Resource Satellite No 1, a sun-synchronous orbiting earth observation satellite operating in transmission mode for earth resource exploration and environmental monitoring. The data can be widely used in agriculture, forestry, animal husbandry, geology, mining, meteorology and hydrology. It weights 1,450 kilograms and has a life of two years. The satellite is a co-operation programme of China and Brazil.

Fengyun (Wind and Cloud) No 2, a geo-stationary orbiting meteorological satellite with a life of three to four years, weighing 505 kilograms. It will conduct global meteorological observation missions including monitoring cloud images, temperature, vapo··· and wind fields as well as monitoring space environment.
(CAST and CD information).

Dongfanghong-3 (East Is Red), a large capacity domestic communications and broadcasting satellite, weighing 2,100 kilograms. It has 24 transponders in C band. (The previous communications satellites had only four transponders each). Each transponder is able to transmit one TV programme or 800 telephones. It has a life of eight years. The satellite is expected to be launched in 1993, and should reduce the congestion of China's telecommunications.

Photos of Future Satellites

91FE0048B Beijing CHINA DAILY in English
26 Sep 90 p 5

[Article: "Space Blueprint". Three photos of satellites being developed, with captions]

[Text]

Another Successful Year for Space Programme

91FE0048E Beijing CHINA DAILY in English
1 Oct 90 p 3

[Article by Li Hong]

[Text] This year has been another good one for the Chinese space programme.

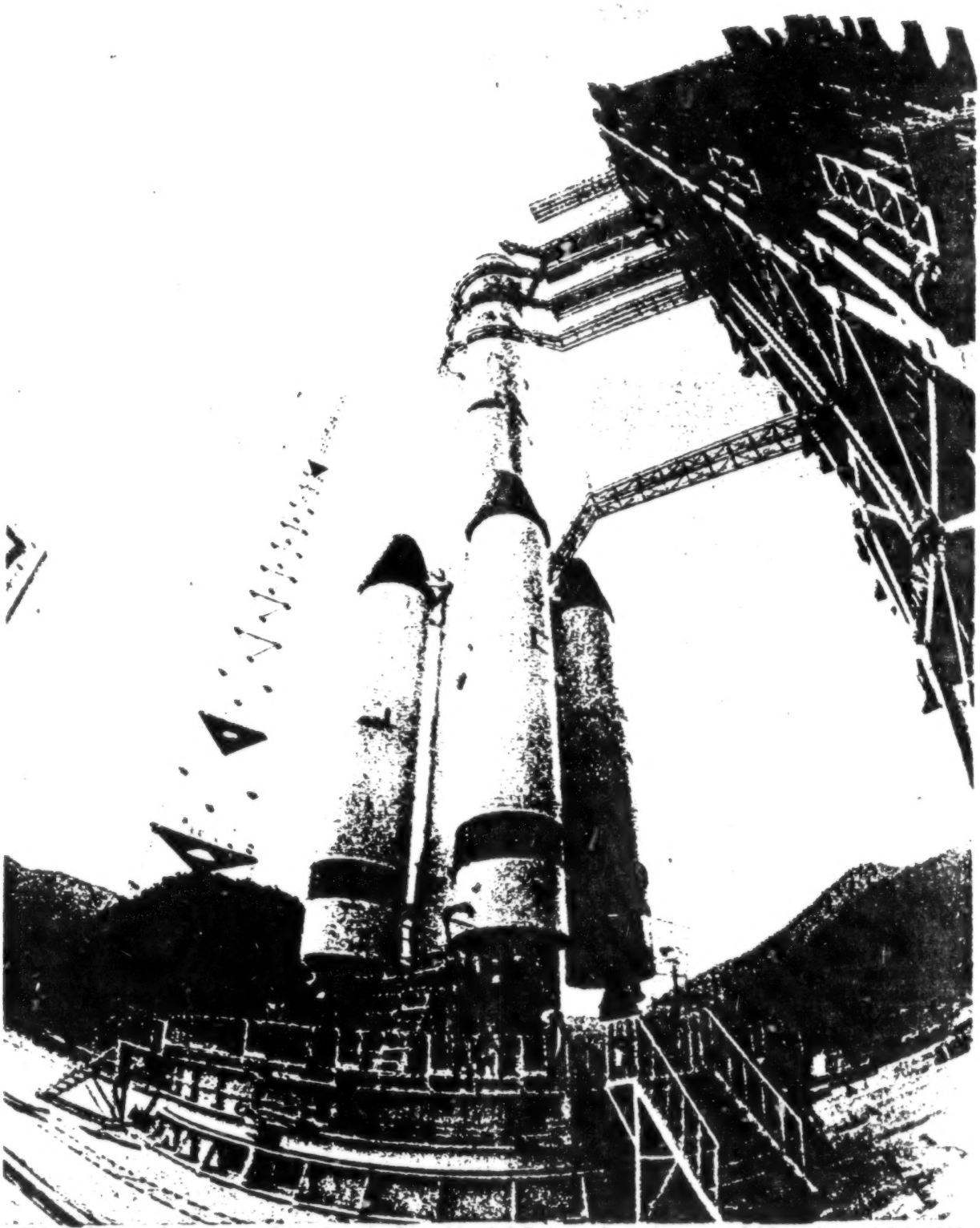
Three of a scheduled five satellites have been successfully put into orbit for domestic and international clients.

China launched the year's first scheduled satellite—it's fifth telecommunications satellite—on 4 February.

On 7 April, the AsiaSat-I, a U.S.-made, 24-transponder telecommunications satellite for the Asia Satellite Telecommunications Co Ltd, blasted off to its distant geostationary orbit, 36,000 kilometres in space, aboard a Chinese-made Long March-3 rocket booster.

The launch marked China's entry into the international satellite launching market.

On 16 July, in a trial launch, a newly developed Long March 2-E rocket successfully carried an experimental satellite into its planned orbit. The operation was a rehearsal for the launch of two big Australian communications satellites, planned for 1991 and 1992. The Long March 2-E can carry an 8.8-ton payload into low Earth orbit, and is powerful enough to deliver a space shuttle into orbit, according to space programme officials.



China's latest and most powerful rocket, the Long March 2-E, just prior to its successful launch on 16 July 1990. The operation was a dress rehearsal for the launch of two Australian communications satellites, scheduled for 1991 and 1992.

Two other launches scheduled for this year include China's 12th retrievable remote sensing satellite, to be carried by a Long March II rocket, and a solar synchronous weather satellite, to be borne by a modified Long March IV rocket.

Research

China's rapid progress in space technology has been the result of more than 2 decades of research and development.

"Our painstaking efforts never stopped, even during the 10 tumultuous years of the 'cultural revolution,' and our strength has been built bit by bit," Sun Jiadong, the former vice-minister of the Aero-Space Industry who headed the development of Dongfanghong-1, China's first satellite, in 1979, told CHINA DAILY in a recent interview.

To date, China has successfully launched 28 satellites, with only one failure.

China has achieved remarkable progress in rocket technology, developing since the 1950s various models of the "Long March" rockets. Twenty of China's 27 successful satellite launches used the Long March carrier rockets, starting with the Long March 1, which delivered the "Dongfanghong 1" into space in 1970.

Later, China added two new members to the family of "Long March" rockets—the reinforced "Long March 2" and the "Long March 3," which can carry 8-ton satellites into near-orbit and 2.5-ton satellites to geosynchronous orbit.

In December 1988, China used its newly developed Long March 4 to launch an experimental weather satellite. The model, a three-stage rocket using conventional liquid fuel, has a lift-off weight of 249 tons, a lift-off thrust of 300 tons, and a payload capacity of 2,500 kilograms.

Two and a half months ago, Chinese scientists successfully launched the Long March 2-E at Xichang in the hilly woodlands of southern Sichuan Province.

China also has launching pads in Jiuquan in Gansu Province, Sichang in Sichuan Province, and Taiyuan in Shanxi Province. A new launching pad is being built on Hainan Island.

"China is the fifth country to develop and launch man-made satellites independently, the third to be able to retrieve multiple satellites with a single rocket, and the fifth to launch geostationary satellites with its own carrier rockets," said Sun Jiadong.

"Our endeavours of the past 40 years have nurtured young scientists who have dedicated themselves to space. They are the backbone of the People's Republic," he said.

Space Industry Joins World League

91FE0048C Beijing CHINA DAILY in English 26 Sep 90 p 5

[Article by Xiao Li]

[Text] China soared into the international satellite launching market on 7 April, as its "Long March 3" rocket booster successfully delivered a foreign-made satellite, Asia-Sat 1, into distant geostationary orbit, 36,000 kilometres above the equator.

In succession, China's powerful four booster reinforced "Long March 2-E" carrier blasted off on 16 July, and then sent its second weather satellite, "Fengyun 1," into a solar synchronous orbit on 3 September.

Over the coming 2 years, China is scheduled to deliver five foreign satellites atop the Chinese made "Long March" series of launch vehicles, including two U.S. made communications satellites for Australia and another one for Arab countries.

These successful space ventures have forced many foreigners to readjust their image of China. Other ventures will force them to continue to do so.

"We made forth strenuous efforts and our strength in the space industry has been built little by little," said Sun Jiadong, former Vice-Minister of China's space industry and a renowned space expert, who led the research and directed the launch of the country's first satellite, Dongfanghong 1 (The East Is Red I), in 1970.

Carriers

As satellites cannot fly without carriers, China has achieved remarkable progress in rocket technology, enabling the country to squeeze into the competitive world launching market.

Since the 1950s, China has developed various models of the "Long March" rocket, which can launch near-earth orbit, solar synchronous orbit and geo-stationary orbit satellites.

The "Long March 1" rocket, which delivered China's first 173-kilogram satellite "Dongfanghong 1" into space is able to send a satellite of up to 200 kilograms into near-earth orbit.

Later, China added two new members to the family of "Long March" rockets—the reinforced model "Long March 2" and the improved model "Long March 3," which can carry 8-ton satellites into near-orbit and 2.5-ton satellites to geostationary orbit.

In December 1988, China used its newly-developed "Long March 4" rocket to launch an experimental weather satellite. The model, a three-stage rocket using conventional liquid fuel, has a lift-off weight of 249 tons, a lift-off thrust of 300 tons, and a payload capacity in solar synchronous orbit of 2.5 tons.

China has launching pads in Jiuquan in Gansu Province, Xichang in Sichuan Province and Taiyuan in Shanxi Province. A new launch pad for space research has been built on Hainan Island, one of the world's few launching pads near the equator.

"China is the fifth country to develop and launch man-made satellites independently, the third to be able to retrieve satellites, the fourth to launch multiple satellites with a single rocket, and the fifth to launch geostationary satellites with its own carrier rockets," Sun said.

Research

In December 1957, the Soviet Union, in fierce competition with the United States, launched its Sputnik near-earth satellite, the first ever. From then on, China was determined to launch its own satellites and manufacture its own rockets as carriers of satellites.

Sophisticated as it is, the launching of a satellite includes four systems: satellite structure, means of delivery, launching sites, and ground control and observation systems. In 1968, nearly all the brains related to space research throughout the country gathered in Beijing to launch China's Academy of Space Technology (CAST).

Soon a preliminary scenario was worked out after a series of feasibility studies. China's Academy of Sciences was to manufacture the satellite body and ground-sensing project, the then Ministry of Astronautics was to make the rocket, and the then Scientific Committee of National Defence was responsible for building the satellite launching site.

Later, they named the satellite "Dongfanghong 1" (The East Is Red I), and decided its weight should not be less than 150 kilograms, as demanded by Chairman Mao Zedong.

The beginning of the chaotic 10-year "cultural revolution" in 1966 seriously disturbed the satellite programme. However, due to the action of the late Premier Zhou Enlai, who ordered the military protection of some key satellite research organizations, most scientists were not forced out of their laboratories.

A landmark date for China's space program is 24 April 1970, when the first independently-made satellite "The East Is Red I" was sent into space.

After the Soviet Union, the United States, France and Japan, China is the fifth country to launch its own satellite.

Space Chronicle: Satellites Launched by China

91FE0048D Beijing CHINA DAILY in English 26 Sep 90 p 5

[Text] To date, China has successfully launched 29 man-made satellites, including AsiaSat-1 and one Pakistan satellite, with only two failures. Four of China's satellites are working.

Date	Satellite	Satellite Weight (kg)	Launch Vehicle
24 April 1970	China's first satellite, the "Dongfanghong" (East is Red) No 1 Satellite. It broadcast the "Music of Dongfanghong" on 20.009 Khz.	173	Long March 1
3 March 1971	A scientific experimental satellite. It worked for 8 years.	221	Long March 1
5 November 1974	A rocket carrying a recoverable satellite exploded 20 seconds after blasting off. The disaster was caused by a broken cable.		Long March 2
26 July 1975	A technological experimental satellite. It took 91 minutes to go round the earth.	1107	Fengbao 1 (Storm 1)
26 November 1975	The first recoverable satellite. It returned to earth 3 days later as scheduled.	1790	Long March 2
16 December 1975	A technological experimental satellite.	1109	Storm 1
30 August 1976	A technological experimental satellite.	1108	Storm 1
7 December 1976	A recoverable satellite. It returned to earth 3 days later as scheduled.	1812	Long March 2
26 January 1978	A recoverable satellite. It returned to earth 3 days later as scheduled.	1810	Long March 2
28 July 1979	An experiment to launch three satellites with one rocket failed.		Storm 1
20 September 1981	A group of three space physics experimental satellites was sent for the first time into predetermined orbit by a single carrier rocket.		Storm 1
9 September 1982	A recoverable remote sensing satellite which returned to earth 5 days later as scheduled.	1783	Long March 2
19 August 1983	A recoverable remote sensing satellite, returning to earth 5 days later as scheduled.	1842	Long March 2
29 January 1984	A communication experimental satellite. Staying in a parking orbit, it failed to enter the geosynchronous orbit. But it finished most experiments.	433	Long March 3
8 April 1984	China's first earth synchronous orbit communication satellite.	433	Long March 3

Date	Satellite	Satellite Weight (kg)	Launch Vehicle
12 September 1984	A recoverable remote sensing satellite, returning to earth 5 days later as scheduled.	1809	Long March 2
21 October 1985	A recoverable scientific and technological sensing experimental satellite, returning to earth 5 days later as scheduled.	1820	Long March 2
1 February 1986	A geosynchronous orbit communication satellite.	433	Long March 3
6 October 1986	A recoverable satellite which returned to earth 5 days later as scheduled.	1820	Long March 2
5 August 1987	A recoverable satellite, carrying two sets of French experimental equipment, returning to earth 5 days later as scheduled.	1820	Long March 2
9 September 1987	A recoverable satellite, conducting microgravity experiments, which returned to earth 8 days later as scheduled.	2100	Long March 2
7 March 1988	A communication satellite. It is still working.	441	Long March 3
5 August 1988	A recoverable scientific and technological experimental satellite, carrying experimental equipment for three West German companies and returning to earth 8 days later as scheduled.	2100	Long March 3
7 September 1988	China's first experimental meteorological satellite—Fengyun 1A. It worked for 39 days.	750	Long March 4
22 December 1988	A communication satellite. It is still working.	441	Long March 3
4 February 1990	A communication satellite. It is still working.	441	Long March 3
7 April 1990	AsiaSat-1, a telecommunication satellite belonging to Asia Satellite Telecommunications Ltd and manufactured by the U.S. Hughes Aircraft Company. The success marked China's entry into the international space market.	1442	Long March 3
16 July 1990	A simulation satellite and Pakistan's first meteorological satellite launched by cluster rocket.	7400	Long March 2E
3 September 1990	Fengyun 1, China's second meteorological satellite. It is still working.	875	Long March 4

**Information provided by the Chinese Academy of Space Technology (CAST) under the Ministry of Aeronautics and Astronautics Industry.

Second FY-1 Experimental Meteorological Satellite Launched

Main Details

91P60004 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 4 Sep 90 p 1

[Article by Wang Liankui [3769 6647 5515] and Wang Hanlin [3769 5060 2651]: "Second Fengyun-1 Experimental Meteorological Satellites Successfully Launched"; see also FBIS-CHI-90-172, 5 Sep 90 p 41, and FBIS-CHI-90-180, 17 Sep 90 p 24].

[Summary] Taiyuan, 3 Sep—At 0953 hours Beijing daylight savings time today, a Long March 4 launch vehicle carrying China's second "Fengyun-1" ["Wind and Clouds 1," abbreviated FY-1] experimental meteorological satellite successfully lifted off the pad at the Taiyuan Satellite Launch Center. At 674.368 seconds, after having headed in a southwest direction, the satellite smoothly entered its assigned sun-synchronous polar orbit. Two Chinese Academy of Sciences' atmospheric-measurement weather balloons also went aloft with the new FY-1.

As with the first FY-1 experimental metsat, launched in September 1988, the new satellite's primary goals are to capture and transmit to Earth imagery and data on clouds, the Earth's surface, marine water color, land-water boundaries, ocean surface temperature, ice and snow cover, and vegetation and crop cover. The imagery, principally intended for atmospheric and ground weather prediction, will be sent to satellite ground stations around the world as well as to the Chinese ground stations.

At 1314 hours Beijing daylight savings time, the Urumqi Meteorological Satellite Ground Station received the first very-high-resolution visible cloud images transmitted by the new FY-1; pictures of the cloud layers were quite clear. The Xian satellite tracking & Control Center and the State Meteorological Administration's Satellite Meteorology Center took part in the successful tracking and orbital insertion of the satellite

Additional Note on Mission, Guangzhou Station

91P60004 Guangzhou NANFANG RIBAO in Chinese 4 Sep 90 p 1

[Summary of two related articles by Xu Zhimin [6079 1807 2404] and Liu Ruixiang [0491 3843 4382]: "Second 'Fengyun-1' Satellite Lifted Off into Space"]

[Summary] Beijing, 3 Sep (XINHUA)—In addition to providing data for weather prediction, the FY-1 metsat launched today will also provide data [on cosmic rays and other particles] for atmospheric physics research [see FBIS-CHI-90-191, 3 Oct 90 p 30] and services to the national economy and to defense construction.

Guangzhou, 4 Sep—The Guangzhou Meteorological Satellite Ground Station yesterday received the first dual-frequency (high frequency and low frequency) telemetry signals from the newly launched second FY-1 metsat at 3 minutes and 48 seconds after launch (i.e., at 0956 hours 54 seconds), and provided tracking information on the satellite's operational state to satellite command authorities for 4 minutes and 17 seconds after that, at which point the satellite passed out of the station's tracking range. The Guangzhou Ground Station, which became operational in 1987, was built primarily for the new generation (FY-1 series) of polar-orbit sun-synchronous metsats.

Additional Note on First Imagery Received

91P60004 Wuhan HUBEI RIBAO in Chinese 4 Sep 90 p 3

[Unsigned article: "China Successfully Launches Second Experimental Weather Satellite"]

[Summary] Beijing, 3 Sep (XINHUA)—At the State Meteorological Administration's Satellite Meteorology Center, this reporter was present as the technical experts received the first cloud pictures from the newly launched FY-1 metsat. The first picture showed a cold air front moving southeast from the Soviet Union's Ural Mountains area, and a cloud cell behind the front could clearly be distinguished. The blue waters of the Caspian Sea and Aral Sea and the mountains and green cultivated fields nearby were also visible beyond the clouds. An expert pointed out that this satellite circles the Earth 14 times per day and can receive and transmit to Earth imagery of China's land and atmosphere 7 times per day. On each pass over China, it sends its data to the ground stations in real time.

Note on Designation, Scanning Radiometer

91P60004 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 7 Sep 90 p 2

[Several related articles by Luo Jibin [7482 4949 6333], Assistant Director of the State Meteorological Administration, et al.]

[Summary] The new meteorological satellite launched the other day is to be designated FY-1B, to distinguish it from FY-1A, the first experimental meteorological satellite, which was launched on 7 September 1988. Both are polar-orbit, sun-synchronous metsats with very-high-resolution scanning radiometers (VHRSR) having four visible detection channels and one infrared detection channel. [For more details on the VHRSR, see special subtitled issue, "FY-1 Meteorological Satellite," JPRS-CST-90-026, 25 Oct 90.]

Orbital Data Published

91P60004 Urumqi XINJIANG RIBAO in Chinese 11 Sep 90 p 2

[Article by Li Jinmei [2621 2516 2734]: "Fengyun-1 Meteorological Satellite"]

[Summary] The FY-1 metsat launched on 3 September has been placed in a polar orbit with the following parameters: altitude is 900 kilometers, inclination is 98.9 degrees, period is 102.86 minutes (equivalent to 14 daily revolutions around the Earth). The satellite carries on board two 5-channel (four visible channels and one infrared channel) very-high-resolution scanning radiometers which have a 2800-kilometer-wide scanning swath.

Details on Flight Path, Satellite Mass

91P60004 Shanghai JIEFANG RIBAO in Chinese 4 Sep 90 p 1

[Summary of three related articles by Zhang Zhiyuan [1728 1807 6678], Xu Zhimin [6079 1807 2404], and Xu Lidong [1776 4539 2639]: "China's Second 'Fengyun-1' Weather Satellite Launched"]

[Summary] The nation's second FY-1 experimental metsat, carried aloft yesterday aboard a 41.9-meter-long Long March 4 launch vehicle, flew over Shanxi, Shaanxi, Sichuan, Guizhou, and Yunnan Provinces. At 693.59 seconds into flight, the satellite separated from the launch vehicle over Vietnam, and the satellite smoothly entered its assigned 900-kilometer-high sun-synchronous orbit. According to the experts, the quality of the received cloud imagery is about the same as that received from the U.S.'s NOAA metsats, and better than that received from the Soviet Union's metsats.

The total payload [FY-1 satellite and two weather balloons] lofted by this Long March 4 was about 900 kilograms, some 132 kilograms more than that lofted by the first Long March 4, which launched the first FY-1 experimental metsat in September 1988. The mass of the second FY-1 satellite is about 96 kilograms more than that of the first. On board the satellite are two VHRSR's, each with one infrared detection channel and four visible detection channels. Resolution is about 1.1 kilometers. The onboard tape recorder can store up to 60 minutes worth of imagery at one time and then transmit to Earth [via the delayed picture transmission (DPT) mode] that recorded imagery at a later time.

More on Satellite Size, Mass, Imagery Applications

91P60004 Beijing CHINA DAILY in English 26 Sep 90 p 5

[Article by Xiao Zhou: "Satellite a Research Giant"]

[Excerpts] China successfully sent a second meteorological satellite into polar orbit early this month. The weather satellite, "Fengyun 1" (Wind and Cloud), is a 875-kilogram hexahedron with a length of 8.6 metres. Two 3.6-metres-by-1-meter solar cell arrays collect energy for the operation of the satellite. [Passage omitted]

So far, the weather information gathered by the FY-1 has already been used in weather forecasting. China's Central TV Station has been broadcasting cloud photos sent by the satellite in its weather forecasting programme since September 4, the day after the launching of FY-1.

The State Meteorological Centre will share with other countries all the information obtained by the satellite. The centre has provided the index of the FY-1 orbit plane to the International Meteorological Organization. With the index, any country in the world with a ground station will be able to receive the satellite information.

Scientist Devotes Life to Satellite

91P60004 Beijing CHINA DAILY in English 26 Sep 90 p 5

[Article by Li Hong: "Scientist Devotes Life to Satellite"]

[Excerpts] The successful launch of China's second weather satellite—"Fengyun 1"—on September 3 excited the country and amazed the world. When the distinguished guests and reporters invited to the Beijing Command Centre to watch the live launch on screen stood up and wildly applauded the spectacular liftoff, a hunched old man at the Taiyuan Launch Site could no longer hold back the tears.

He is Huang Anshen, the "stubborn" researcher of Shanghai Satellite Technology Academy and one of the outstanding contributors to the country's weather satellite programme. He is lauded as the "first soul" of the "Fengyun 1."

Huang looks much older than a man in his forties. His devotion to researching the problem of the automatic loading and unloading of satellite's solar batteries has taken a lot out of him. [Passage omitted]

In the mid-1980's when China decided to develop solar batteries to be installed in its first weather satellite, Huang and his colleagues began their crucial research under intense pressure. At that time a number of weather satellites had failed due to insufficient research into the use of batteries in space. [Passage omitted]

Huang knew that he owed a great deal to his wife, but he could not give up his work on the satellite. During her last few days in the hospital, Huang worked hard in the daytime so as to be with her at night and give her the support she needed and deserved. Meanwhile, his older son was left to take care of his younger brother.

When that autumn gave way to winter, the initial test of the solar battery succeeded. But just at that moment of success, his wife died.

Later, Huang's two children were admitted to Shanghai schools and the academy paid all of the 6000 yuan hospital bill, for which Huang was very grateful. [Passage omitted]

The news of the successful launch of the first weather satellite on September 7, 1988 comforted Huang and inspired him to overcome his illness. He agreed to accept radiation treatment and chemical therapy. Later, after an operation, he practiced "qigong."

Huang's spiritual willpower defeated his cancer. He said that he was luckier than his wife. Huang asked to join the research team for China's second weather satellite and has played a major role in resolving a number of serious technical problems.

After the magnificent scene at the launch site, he said he would continue to give his remaining years to China's aero-space programme.

Achievements of Navy Aeronautical Engineering Institute Highlighted

91P60020 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 24 Sep 90 p 2

[Article by Wang Hanlin [3769 5060 2651]: "13 Scientific Achievements of Navy Aeronautical Engineering Institute Receive Awards"]

[Summary] In the first 6 months of this year, 13 scientific achievements of the Navy Aeronautical Engineering Institute received national-level or Armed Forces-level awards for scientific or technical advancements. The "CAMAC [computer] automated measurement [and control] system for Navy Antiship Missiles," which recently passed technical appraisal, successfully resolves the problem of matching the high-frequency, high-voltage missiles with low-frequency, low-voltage CAMAC system equipment, thereby standardizing and modernizing—to Eighties international standards—the process of maintaining and employing the tactical missiles on active duty in the Navy. The "Navy Missile Weapons Systems Simulator Project" incorporates high-power pulse-width speed regulation, computer real-time control, digital video image synthesis, and other technologies and realizes hardware-in-the-loop simulation as well as simulation of missile weapons systems. This will be a powerful tool for teaching, military exercises, scientific research, and engineering.

Infrared, Thermal Stress Properties of Composite Ceramics of Mn, Fe, Co, and Copper Oxides

91FE0021A Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 4, Aug 90 (manuscript received 12 Sep 89) pp 322-328

[Article by Yang Jun, Tang Daxin, Wang Hui and Dong Xijuan, Institute of Atomic and Molecular Physics, Jilin University)

[Abstract] The infrared spectra of composite ceramics of Mn, Fe, Co and Cu oxides are studied. The experimental results show that these composite ceramics possess excellent specific infrared emissivity in a broad band. In the range of 4800-400cm^{-1}, the total emissivity is more than 0.93. The surface optical properties of the ceramics are greatly changed when an efficient radiation layer is sprayed on their surfaces. Because the total inner reflection caused by the boundary surface and addition of feldspar are restrained by this radiation layer, the emissivity of this kind of composite ceramics is improved. Heating measurement shows that the infrared radiation heating effect of the material is better than that of several kinds of commercial radiation materials and the thermal stress properties are also better.

HREM Observation of Defects in Beta-SiC Whiskers

91FE0021B Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 4, Aug 90 (manuscript received 15 Apr 89) pp 329-335

[Article by Cao Li, General Research Institute for Non-Ferrous Metals; Yao Zhongkai, Harbin Institute of Technology; Chen Jun and Yang Tong, Nanjing University]

[Abstract] In this paper, the microstructure and defect of β-SiC [beta silicon carbide] whiskers are observed directly by high-resolution electron microscopy (HREM) and high-resolution photographs of 2 angstrom resolution are obtained. The results show that there are many stacking faults parallel to the (111) and [begin set] 111 [end set] planes in the silicon carbide whiskers. Frank partial dislocations and multiplicate twins and the complicated atom arrangement in the twin regions are also discovered. Finally, the growth mechanism of β-SiC whisker is analyzed.

Effect of Cooling Mode on Transformation, Mechanical Properties of Y203-Zr02 Ceramics

91FE021C Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 4, Aug 90 (manuscript received 24 Jul 89 pp 336-341

[Article by Deng Keneng, Jin Zhihao, and Wang Xiaotian, Xian Jiaotong University]

[Abstract] Effect of four different cooling modes on τ-m transformation and mechanical properties of Y_2O_3-ZrO_2 ceramics were studied. Experimental results show that τ-ZrO_2 phase content changes due to different cooling modes in the test, which relates to the nucleation in τ-m transformation. Nucleation process is a function of temperature and time. Initial temperature (M_s) of transformation decreases with the increase of cooling rate, and the final temperature M_f) of transformation does not change with cooling rate.

High-Frequency Ultrasonic Evaluation of Polycrystalline Diamond Composite

91FE0021D Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 4, Aug 90 (manuscript received 25 Sep 89) pp 347-352

[Article by Ma Di, Wang Mingzhong and Dong Jianhua, Shanghai Institute of Ceramics, CAS)]

[Abstract] Ultrasonic waves of different frequencies were used to detect defects in polycrystalline diamond composite (PDC). The standard waveform was given. The position of a defect in the composite could be identified easily. Detection of longitudinal cracks with a transverse wave was successful. The acoustic parameters and the elastic parameters of PDC were measured and the destructive mechanism was primarily discussed.

Improvement of Surface Electrical Properties of Al_2O_3 Ceramics by Fe Ion Implantation and Annealing

40090028C Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 3, Jun 90 pp 237-244

[Article by Li Shipu, Wang Guomei, Ren Wei, Xing Ning, and Chen Xiaoming, Wuhan University of Technology]

[Abstract] Translucent aluminium oxide is implanted with Fe^{2+} ions. The resistivity of implanted films and the Hall effect are measured by the "Van der Pauw" method, and the carrier concentration and mobility are determined.

In this paper, surface electrical properties of Fe-ion-implanted Al_2O_3 with and without annealing are compared. In order to obtaining some informations for lattice damage and recovery, longitudinal concentration distribution of implanted ions and defects, the Rutherford backscattering technique, X-ray electron spectra and X-ray diffraction are used. (MS received 21 Mar 89)

Finally, the film conduction mechanism is discussed briefly.

Phase Transformation Behaviors of Ce-TZP Ceramics Under Stress

40090028B Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 3, Jun 90 pp 228-236

[Article by Huang Yong, Zeng Zhaoqiang, Ding Bo, Zheng Longlie, and Jiang Zuozhao, Qinghua University, Department of Materials Science and Engineering]

[Abstract] In this paper, the stress-strain curves of Ce-TZP ceramics with various CeO_2 contents sintered at different conditions are investigated. Changes of tetragonal and monoclinic zirconia fraction under stress are measured. The results show that yield and plastic deformation take place under tensile stress. At the same time it is found that yield, shape-memory effect and texture are all related to the phase transformation t-ZrO_2 to and from m-ZrO_2. The causes and conditions of yield occurring in Ce-TZP ceramics are discussed in detail, and the relationships among stress, strain, temperature and phase transformation are studied. (MS received 24 Jul 89)

Mechanical Properties and Toughening Mechanism of (Ce-TZP)-Al_2O_3 Ceramics

40090028A Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE CERAMIC SOCIETY] in Chinese Vol 18 No 3, Jun 90 pp 211-218

[Article by Chen Zhigang, Chen Peifang, and She Zhengguo, Jiangsu Institute of Technology]

[Abstract] The effect of Al_2O_3 content on strength, hardness and toughness of (Ce-TZP)-Al_2O_3 ceramics is studied. Hardness and strength are increased and a comparatively high toughness is obtained when the alumina content in (Ce-TZP)-Al_2O_3 composites is in the range of 10-20wt%.

Toughening mechanism of Ce-TZP ceramics is studied by means of wear test and X-ray diffraction phase analysis. It is found that the resistance of the material to micro-fracture is consistent with the increase of the monoclinic phase content on the worn surface. Thus, it is believed that Ce-TZP ceramics are mainly toughened by T to M phase transformation mechanism. (MS received 9 Sep 89)

Parallel Compilers in Domestic Supercomputers Described

91P60010A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 35, 12 Sep 90 pp 47, 49

[Article by Zhang Zhide [1728 1807 1795] and Xu Zuyuan [1776 4371 3220] of the Beijing Institute of Computer Applications and Simulation Technology: "On the Topic of Parallel Compiling"; see also JPRS-CST-89-006, 28 Feb 89, pp 64-66]

[Summary] Realization of parallel compiling requires an orientation toward a specific programming language. For example, software implementation for China's YH-1 [Galaxy-1 supercomputer] was based on a vectorized FORTRAN language. The YH-1's parallel compiling software consists of a YH-1 FORTRAN vector recognizer and a YH-1 vector FORTRAN compiling system.

Among parallel computers, vector computers are a relatively important type. Some examples are the Cray-1 supercomputer; the Convex C series [of minisupercomputers]; and the 757, YH-1, and other computers developed and built in China in the 1980s. Essentially all vector computers have been developed around a vector FORTRAN compiler and vector recognizer. The principal function of a vector recognizer is to carry out vectorized processing of the statements within a serial language program loop—to permit parallel execution of vector instructions.

In the general area of parallel computer development, much activity centers around the C programming language. Several domestic research units have already implemented their own parallel C compilers.

China Reaps Benefits of Computer Science

40100004 Beijing CHINA DAILY in English 1 Oct 90 p 3

[Article By Chang Hong]

[Text] The land of the abacus has arrived in the computer age.

From government offices and businesses to video-game parlours, the soaring popularity of computers among professionals and hobbyists has put the industry in the forefront of China's economic development.

Computer science has already been worth billions of dollars to the nation—some of it in direct, economic benefits from hardware and software sales, some of it in hidden gains from savings of time and money.

"Before 1981, computer use was chiefly experimental, for defence and scientific purposes," said Yang Zhaoming, a senior engineer with the Ministry of Machinery and Electronics Industries. "Now we have an industry that serves the whole economy."

There are an estimated 400,000 personal computers in China; 60 to 70 percent of these were made here, compared to only 24 percent in 1981.

"We now produce complete computers, spare parts, peripheral devices, and application systems, as well as monitors, printers, and magnetic recording equipment," Yang said.

In addition, he said, a computer sales, training, and maintenance service network has taken shape.

During the Seventh 5-Year Plan (1986-90), China has developed several mainframe computers, including the Great Wall, Taiji, and Zijin series. Chinese designers have also been successful in developing software and computer applications.

One notable achievement has been the adaptation of computers to accept Chinese characters.

Before 1985, most Chinese computer users bought foreign-made computers. In 1985 alone, $1.2 billion was spent on computer imports. Last year this dropped to $389 million.

Yang said his ministry is planning to vigorously promote the export of Chinese-made computer products in the Eighth 5-Year Plan period.

One target of the plan is to top the $163 million earned last year in computer exports. Officials hope to reach $1 billion in exports by 1995.

During the 1991-95 period, the government plans to set up four computer production bases for export—in Guangdong and Fujian provinces, the Yangtze River delta region, and the Bohai Bay area.

About 900 million yuan ($191 million) will be invested in existing producers in these areas to expand production capacity and improve the quality of their products.

Generations

China's first generation of computers—an electron tube calculator copied from a Soviet model—was introduced in 1958. It was made in the Computing Technology Institute under the Chinese Academy of Science (CAS) in Beijing.

From there, technology rapidly progressed from transistors to integrated circuits.

China's computer technology is now in its fourth generation of development, taking in large-scale integrated circuits.

The CAS institute is now experimenting with the fifth generation of computer technology, which aims to duplicate the functions of the human brain.

Domestic Advances in Fuzzy Control Highlighted

91P60006A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 34, 5 Sep 90 pp 47, 49

[Article by Huang Zhiwei [7806 2535 0251] of the Hengyang Municipal Electronics Research Institute: "Research Trends in Fuzzy Control"]

[Summary] Chinese researchers began studying fuzzy control technology in 1979, and in the past 10 years they have investigated applications of this technology in automatic process-control systems, weather forecasting, medical diagnosis, blast-furnace smelting, nonferrous smelting, artificial intelligence and management engineering, among others. Several noteworthy breakthroughs attracting worldwide attention have been made.

At the Second IFSA Conference held in Japan in 1987 and attended by 360 representatives of 25 countries, Chinese researchers contributed 50 of the 210 scientific papers (with Japanese, West European, American, East European, and other researchers contributing 51, 45, 30, 17, and 13 papers, respectively).

Fuzzy logic chips and fuzzy inference engines—

The Chinese Academy of Sciences' Institute of Semiconductors has developed two multi-element logic circuit product series, the DYL-S series and the DYL-A series, totaling 20 products. The multi-element logic circuits process operations with two-value logic, multiple-value logic, and continuous-value logic (viz., fuzzy logic).

China's first fuzzy inference engine was perfected at the Fuzzy Mathematics Laboratory in the Mathematics Department of Beijing Teachers' University (BTU). Using independently developed concepts and independently designed circuits, this fuzzy inference engine has a processing speed of 15,000 [sic, should be 15 million; see JPRS-CST-88-014, 25 Jul 88, pp 116-117] inferential operations per second.

In August 1988, BTU professor Wang Peizhuang [3076 1014 8369] gave a lecture at the APT Instruments Company in Tokyo on his theory of factor space analysis and on his work toward a hardware realization of a true-valued inferential scheme for rule-based fuzzy inference. Based on systems where the number of input/output variables is restricted to 2000, Professor Wang has developed hardware and accompanying STIM software with about 30,000 basic rules; these products are scheduled to be on the market this year (1990).

In 1988, Professor Tian Chengwen [3944 2052 2429] of the Computer Applications Institute at North China Industrial University (NCIU) completed a 6-year study of microcomputer fuzzy control theory and applications.

Fuzzy controllers—

Li Baoshou [2621 1405 4849], Liu Zhijun [0491 1807 0193] and their colleagues have applied continuous digital simulation methods to study the performance of typical fuzzy controllers. Qinghua University's Zheng Weimin [6774 4850 2404] and others, applying fuzzy set theory, have analyzed the adaptiveness of fuzzy controllers. Researcher Chen Guoquan [7115 0948 2938] and others have studied simplification of algorithms for fuzzy controllers. Song Dapeng [1345 1129 7720], Wang Peizhuang and others have studied circuit implementation and software design for fuzzy controllers. "A Study of Responsiveness in Fuzzy Controllers," jointly authored by Professor Wang and Lou Shibo [2869 0013 0590], was the second pure theoretical paper to be published in the world on the topic of fuzzy control theory.

In 1987, Dou Zhijie [6757 1807 2638] and others at the Staff & Workers College of the Shanghai Instrument and Meter Industrial Company completed development on a proportionality-factor-type fuzzy controller using an 8039 single-chip microprocessor, and in 1990 they completed development on a three-loop fuzzy controller using fuzzy decision algorithms. Researchers at NCIU and at East China Institute of Engineering are also active in the area of fuzzy controllers.

Industrial process control—

Professor Xiong Qiusi [3574 4428 1835] and others at the Electrical Engineering Department of Hunan University have employed computers to achieve fuzzy composite control in gas smelter control systems. Zhengzhou Institute of Light Industry's He Gang [0149 6921] has studied fuzzy control for reaction temperature in alkali fusion vessels. Liu Langzhou [0491 3186 5297] and colleagues at the Wuhan First Scientific Research Institute of Light Industry have developed a TRS-80-microcomputer-based computer fuzzy control system for a glass kiln. Applying fuzzy theory, researchers at the Handan Resin Plant have developed a microcomputer based control system for the PVC resin polymerization process. Yu Xuliang [0060 2485 0081] and colleagues at the Department of Automation at the University of Petroleum have studied fuzzy control in large hysteresis systems for chemical engineering processes. [See also JPRS-CST-90-022, 29 Aug 90, p 27, and JPRS-CST-90-024, 25 Sep 90, p 13.]

Equipment control—

Researchers at the Ministry of Chemical Industry's Chemical Fertilizer Industrial Institute, at Jilin Industrial University, and at the Ministry of Metallurgical Industry's Metal Products Institute have studied applications of fuzzy control theory for compressor regulation, power factor compensation, and direct-current reversible-speed regulation, respectively. Researchers at

NCIU have developed a digital dual-frequency-channel amplitude-frequency instrument based on microcomputer fuzzy control theory.

Researchers at the Air Force Institute of Engineering in 1988 developed a fuzzy quantitative evaluation expert system for aircraft maintenance. In 1985, Nanjing University professor Bao Ziwei [0545 4793 1792] employed fuzzy mathematics to analyze the process of subjective evaluation of sound quality in electro-acoustic devices [i.e., in high-fidelity sound systems].

Professor Li Zonghua [2621 1350 5478] of the Armed Forces Economics Institute and others have proposed a quantized input technique for natural fuzzy language information in expert systems. Wang Shitong [3769 0013 0681] and colleagues at the Zhenjiang Shipping Institute have applied dBASE III on an IBM PC XT to develop the fuzzy database inquiry system FRES. Finally, Li Fan [2621 0416] of Central China University of Science and Technology has researched various fuzzy quantization methods used in knowledge engineering.

High-Power Pulsed YAG Laser

Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 17 No 4, 20 Apr 90 (MS received 5 Dec 89) p 216

[Article by Zhang Rui [1728 6904] of the Department of Fine Instruments, Tianjin University: "High-Power Pulsed YAG Laser"]

[Text] On 28 November 1989, the high-power pulsed YAG laser developed by the Department of Fine Instruments at Tianjin University successfully passed evaluation by the Science Committee of Tianjin. The main specifications of the laser include using two medium-quality 8-mm-diameter 106-mm-long YAG rods, a laser pulse with a mean maximum output power of 528.75 W at 1.06 μm, repetition frequency at 400 Hz, single-pulse energy of 23 J, pulse width of 0.3-5.6 ms, divergence angle of less than 10 mrads, and instability below 2 percent during high-power output (over 400 W) over long periods of time.

The device uses a high-power silicon-controlled switch power supply which was specifically developed by the Department of Fine Instruments at Tianjin University and Shenyang Institute of Electrical Engineering for pulsed solid state lasers. The core components of this power supply are all domestically made. The capacity per unit is 2 x 15 kW and the repetition frequency is 200 Hz. Its specifications also passed evaluation at the same time.

10 GW Tunable Nd:Glass Laser System Evaluated

90FE0289B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 17 No 4, 20 Apr 90 (MS received 7 Dec 89) p 216

[Article by Wu Hongxing [0702 7703 5281], Guo Dahao [6753 1129 3185], Wang Shengbo [3769 5116 3134] and Dai Ningsheng [2071 1337 3932]: "10 GW Tunable Nd:Glass Laser System Completed and Passed Evaluation"]

[Text] Since 1979, the powerful Laser Physics Laboratory at China Science and Technology University has been developing a novel 10 GW tunable Nd:glass laser. After 10 years of hard work, it has been successfully completed. Moreover, it passed the evaluation by the Chinese Academy of Sciences on 25 November 1989.

This 10 GW high-power Nd:glass laser has a continuously tunable output lasing wavelength. The system consists of a tunable narrow-band Q-switched Nd:glass laser oscillator, a two-stage Nd:glass laser pre-amplifier, a three-stage 20-mm-diameter 500-mm-long Nd:glass laser main amplifier, a three-stage 35-mm-diameter 500-mm-long Nd:glass laser main amplifier, a two-stage 45-mm-diameter 500-mm-long Nd:glass laser main amplifier, an electro-optic wave-absorbing switch, an electro-optic isolation switch, spatial filters and two Faraday optomagnetic isolators.

The main specifications of the device include: tunable wavelength range greater than or equal to 28.6 nm [(λ_o+ 23.8 nm) - (λ_o - 4.8 nm)], laser pulse width (FWHM) [full width at half maximum] less than or equal to 4 ns, laser pulse energy greater than or equal to 66.5 J when wavelength is within the tunable range of $\Delta\lambda >$ 16.4 nm [(λ_o + 12.0 nm) - (λ_o - 4.4 nm)], peak power of laser pulse greater than or equal to 1.66 x 10^{10} W, laser line width less than or equal to 0.064 nm, divergence angle of laser beam less than or equal to 0.36 mrad (less than or equal to 9.7 times diffraction limiting angle), and fluctuation of output laser pulse energy and peak power less than or equal to 10 percent.

Properties of New Crystal YAG Laser

90FE0289A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese, Vol 17 No 4, 20 Apr 90 (MS received 5 Jun 89) p 197

[Article by Zhang Siyuan [1728 1835 6678], Wang Qingyuan [3769 1987 0337] and Wu Shixue [2976 1102 1331] of Changchun Institute of Applied Chemistry of the Chinese Academy of Sciences and Zhai Qingyong [5049 3237 3057], Liang Zerong [2733 3419 2837] and Sun Hongjian [1327 3163 1696] of Southwest Institute of Technical Physics: "Properties of New (Ce^{3+}, Nd^{3+}): YAG Laser Crystal"]

[Text] The (Ce^{3+}, Nd^{3+}): YAG [Yttrium aluminum garnet] laser crystal being studied primarily utilizes the sensitization of Ce^{3+}-Nd^{3+} to improve laser efficiency. Ce^{3+} ion has two absorption peaks in YAG, i.e. 340 nm and 460 nm. Its fluorescent band is at 500-700 nm and the peak wavelength is at 550 nm. Several absorption peaks of Nd^{3+} are in this region, including main excitation peaks of Nd^{3+} near 580 nm. Research shows that energy transfer between Ce^{3+} and Nd^{3+} takes place in two ways. One way involves a radiation absorption process; i.e. the fluorescence of Ce^{3+} is absorbed by Nd^{3+} and converted to laser light emitted by Nd^{3+}, as shown in Figure 1. The curve in the middle of the figure corresponds to the absorption spectrum of Nd^{3+}. The dotted curve is the fluorescence spectrum of Ce^{3+}. The other way is a radiationless process. The life of a single Ce^{3+} ion in YAG was measured to be 68 ns. When doped with both Ce^{3+} and Nd^{3+}, the life of Ce^{3+} is about 30 ns. This indicates the presence of radiationless transition between Ce^{3+} and Nd^{3+}. Based on experimental data, the transition probability from Ce^{3+} to Nd^{3+} is of the order of 10^7 s^{-1}. It is several orders of magnitude higher than that doped with Cr^{3+}. The laser characteristics of this crystal were also studied. The crystal is 5 mm in diameter and 80 mm long. It was pumped with a Xe lamp. When the input is at 10 J, the static laser point efficiency is 3 percent and the slope efficiency is 4 percent. The laser threshold could be as low as 1.5 J. Therefore, it is a highly efficient, low-threshold crystal. In terms of overall characteristics, it is better than a Nd^{3+}: YAG laser

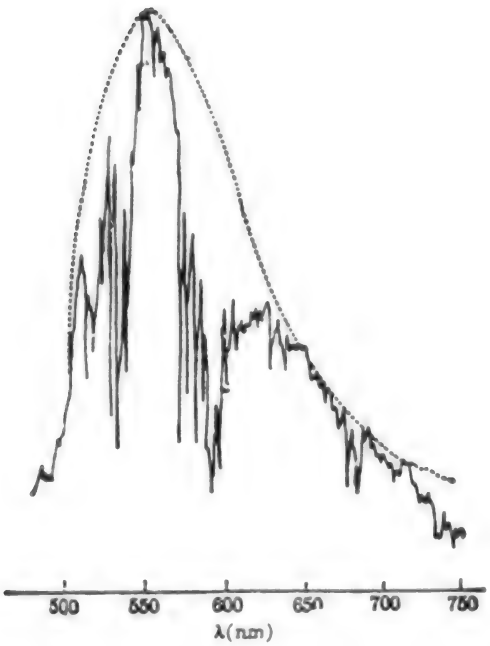


Figure 1. Fluorescent Spectrum of Ce^{3+} in(Ce^{3+}, Nd^{3+}): YAG Crystal

crystal. In addition, it was demonstrated experimentally that this crystal is resistant to ultraviolet radiation; there is no need to filter ultraviolet. It is especially suited for medium- and low-power devices in pulse mode.

Far-Field RCS Scattering by Plate Partially Coated With Lossy Dielectric Strip

90FE0310A Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 18 No 4, Jul 90 pp 12-18 (MS received Mar 89, revised Dec 89)

[Article by Ou Yang [2962 2799] of the Nanjing Research Institute of Electronic Technology and Yuan Chengli [7086 2052 4409] of the University of Electronic Science and Technology, Chengdu: "Far-Field Scattering by Plate Coated With Strips"]

[Excerpts] Abstract: In this paper, an analytical formula for the far-field RCS [radar cross section] of a plate partially coated with lossy dielectric strips is derived by applying the theorem of superposition and a physical optics (PO) approximation to the existing formula for high-frequency diffraction coefficients of an impedance wedge. The results of this paper are in good agreement not only with experiments but also with published data.

I. Introduction

Recently, the use of absorbing materials consisting of dielectric strip coatings has attracted considerable attention in stealth technology development. This approach is of great practical value because it not only can reduce the target RCS but also avoids the use of expensive absorbing materials with extra weight penalties; furthermore, it has essentially no impact on the original vehicle structure.

The electromagnetic properties of a coated surface can be expressed in terms of its surface impedance. In this paper, we have studied the far-field scattering of a plate coated with dielectric strips based on the far-field diffraction coefficients of a typical impedance wedge given in Refs. 4, 5. The results presented include the existing results for a conducting plate[1] and for a fully coated plate;[2] these results suggest the use of partially coated strips to reduce the RCS. [passage omitted]

IV. RCS Measurement System

The directional pattern of the strip-coated plate was measured using the experimental setup shown in Figure 3.

The system uses the intrinsic property of the magic-T [network] to cancel the background noise, and achieves enhanced receiver sensitivity using frequency-mixer amplification. The theoretical measurement limit of this system is -34.23 dBsm [decibels per square meter], and the measurement error for a target with $\sigma > -2$ dBsm is $\Delta\sigma < 3$ dBsm.

V. Data Analysis and Discussion

Figure 4 shows the comparison between the far-field RCS patterns for a conducting plate and a fully coated plate as calculated in this paper and the measured results and other calculated data given in the literature. Figure 5 shows a comparison between the calculated far-field RCS for a strip-coated plate and the experimental results obtained by the authors; the good agreement between the two provides a validation of the analytical formula given in this paper. Based on these results, we can proceed to discuss the effects of such parameters as the position, the width and thickness of the coated layer, the dimensions of the scattering plate, the frequency of the incident wave, and the dielectric constant of the coated material in the far-field diffraction field. Due to space limitation however, we shall discuss only the effects of the width and the position of the coated strip (Figure 6); for a more detailed discussion see Ref. 6.

On the basis of the above analysis and discussion, several important conclusions can be drawn with regard to the reduction of plate scattering:

1. The dimensions of the scattering plate should be minimized and the shape should be optimized to keep the projected area as small as possible. Analysis shows that the plate RCS increases rapidly as the width increases and as the direction of incidence approaches normal.

2. For a simple plate structure, partial coating is not as effective as full coating because a partially coated surface has discontinuities that may cause secondary reflections. But partial coating can produce significant improvements in the diffraction field as a result of phase superposition and energy constraint by the dielectric medium. Center-strip coating can reduce the RCS in the direction of specular reflection, whereas edge-strip coating can

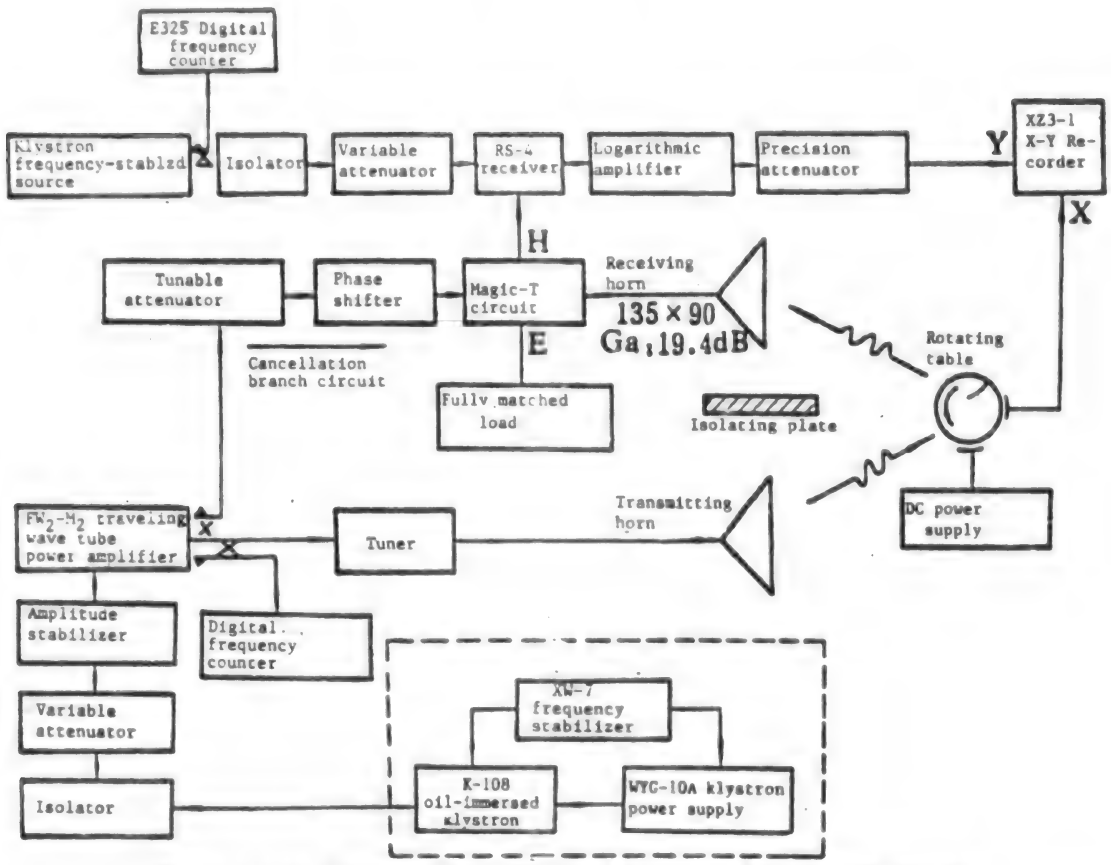


Figure 3. 3-cm Continuous-Wave RF Quasi-Monostatic Measurement System

reduce the average RCS; the position of the individual strip has little effect on the far-field diffraction field.

3. The RCS increases sharply with increasing frequency of the incident wave; in the vicinity of the grazing direction, the RCS is highly dependent on the incident polarization.

4. By using a multiple-layer structure with slowly varying impedance, it is possible to achieve incident-wave matching to minimize reflection, thereby lowering the RCS.

5. Full coating can reduce the RCS amplitude of the plate, but it cannot change the far-field distribution of the diffraction field; this is consistent with the physical meaning of the formula: $\sigma_{coated} = \Gamma^2 \times \sigma_{uncoated}$.

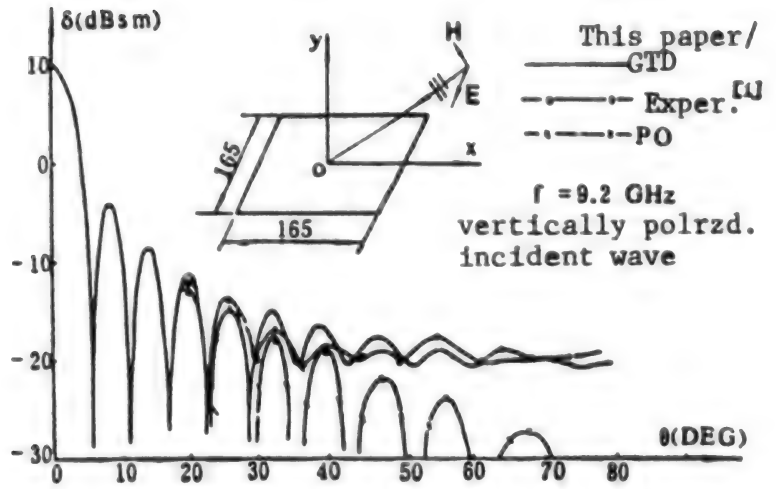
6. A magnetically lossy medium is more effective in reducing the RCS than an electric medium because the magnetic induction strength of a plane wave is much smaller than the electric field strength (qed $\varepsilon_0 E^2 = u_0 H^2$); hence it has a greater disturbing effect on the magnetic field.

7. In order for the results of the model tests to be useful, a coating layer with high surface conductivity is required to satisfy the approximate scaling relations.

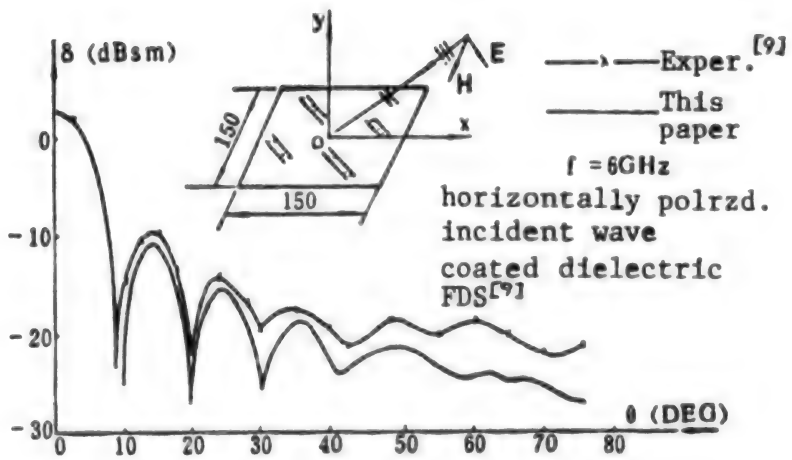
It should be pointed out that the use of coating is only a transitional solution; much better stealth performance can be achieved by using a structure made of composite materials than a coated metallic structure. The United States has already succeeded in building a highly effective stealth bomber, the B-2, using carbon-fiber composite materials.

VI. Concluding Remarks

In this paper, an analytical formula for the far-field RCS of a plate partially coated (uncoated, fully coated) with a dielectric strip is derived by applying the theorem of superposition and a physical-optics approximation to the existing formula for diffraction coefficients. The method presented in this paper can be easily extended to treat the problems of multi-layer coating, multi-dielectric strip-coating, and multiple diffractions. Although this paper only considers the case of a single station [i.e., monostatic radar], it is clear that equation (16) can also be applied to the case of quasi-monostatic setup; also, while the discussion here is limited to the cases of center-strip and edge-strip coatings, the formula is also applicable to the cases of coating with three different dielectrics and two-sided coating. However, it must be pointed out that the method proposed in this paper is only approximate, with limited applications. There are many other interesting and meaningful issues—such as a scattering plate of arbitrary shape, incident wave from arbitrary directions, arbitrary form of coating, and the effect



(a) Metal conducting plate



(b) Fully coated plate

Figure 4. Far-Field RCS Patterns of an Uncoated Plate and a Fully Coated Plate

of multiple diffractions and angular diffraction—that cannot be treated by this method. These issues will require further research.

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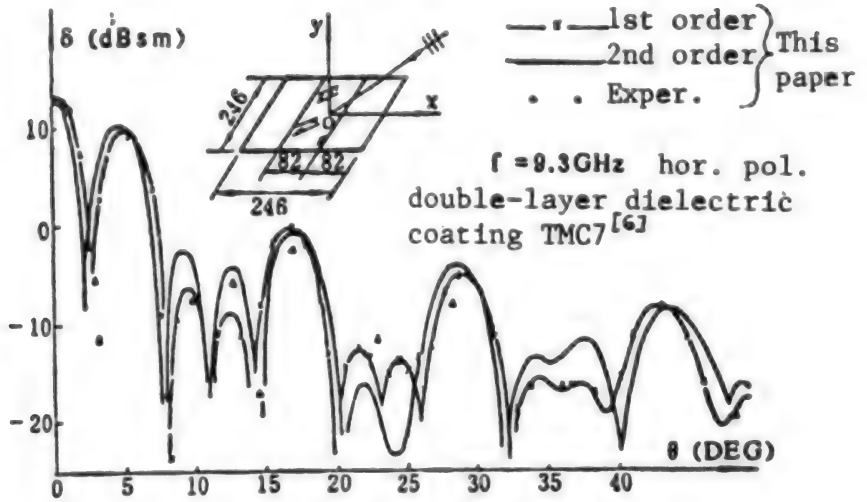
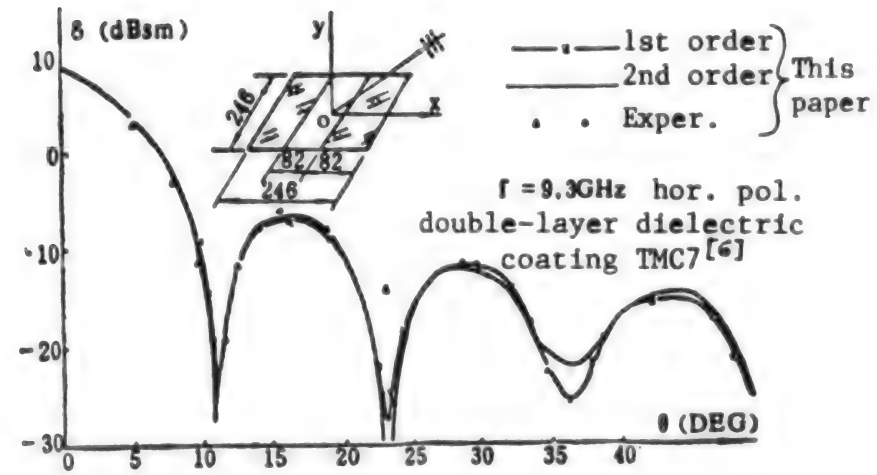
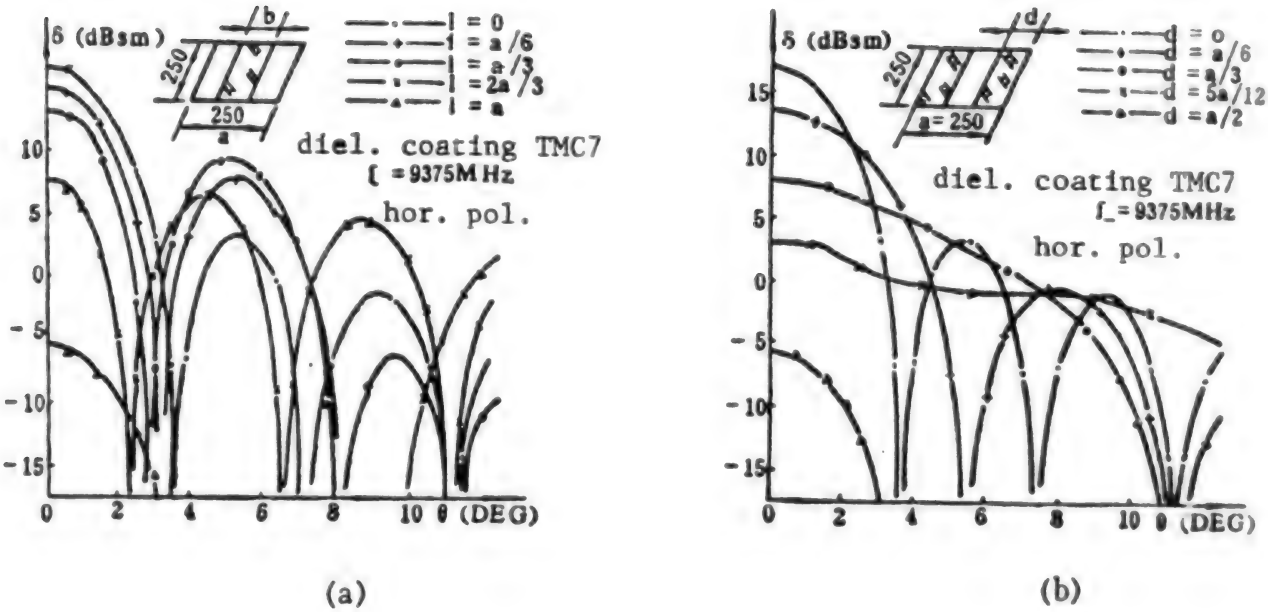


(a) Center strip coating



(b) Edge strip coating

Figure 5. Calculated and Measured Far-Field RCS of a Plate Coated With Dielectric Strips



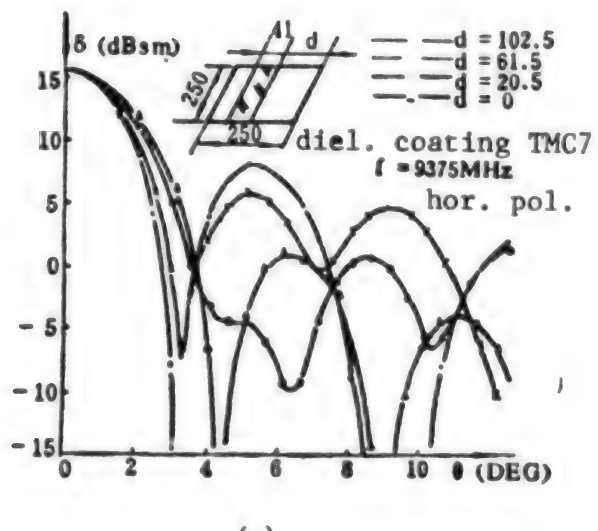


Figure 6. Effect of the Width and Position of Coated Strip

Digital LSI Testing System Developed

90P60075B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 32, 15 Aug 90 p 1

[Article by Liu Jiuru [0491 0046 1172]: "Digital Large-Scale Integrated Circuit Testing System Developed"]

[Summary] The SP316OX digital large-scale integrated circuit (LSI) testing system or "IC CAT" [integrated circuit computer-aided testing] system jointly developed by the Beijing Automatic Testing Technology Institute and by Beijing Keli [4430 0500] New Technology Development Corporation recently passed the new-product appraisal sponsored by the Ministry of Machine-Building & Electronics Industry. This general-purpose LSI testing system is geared toward testing of various kinds of random logic digital IC's. It is a high-speed, high-precision, highly modularized computer-aided testing system for TTL, ECL, NMOS, and CMOS [transistor-transistor logic, emitter-coupled logic, n-channel metal-oxide semiconductor, and complementary metal-oxide-semiconductor, respectively] random logic digital IC's ranging from small-scale integration to LSI, especially for testing and measuring DC parameters, dynamic performance, and AC parameters. Testing speed is 12.5MHz, and the number of test channels is 64 (input/output). The system sells for one-third to one-fourth the price of similar foreign-manufactured units.

Microcontrolled Diffusion Furnaces Developed

90P60075A Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese 8 Aug 90 p 2

[Article by Yang Weiquan [2799 4850 0356]: "Plant 700 Develops Equipment for Producing Microelectronics Devices"]

[Summary] Recently, Beijing Plant No 700 announced development of four types of modern microprocessor-controlled diffusion furnaces and of a mass-flow-rate controller, equipment critical to the manufacturing of precision, high-quality microelectronic devices. The development of this equipment, which has passed the design finalization sponsored by the Ministry of Machine-Building & Electronics Industry, has broken the tradition of blindly importing such equipment for production lines. Already 134 of the furnaces, suitable for production of LSI circuits, have been sold. These diffusion furnaces and the third-generation fast-reaction mass-flow-rate controller meet international standards of the eighties.

Types, Properties of Fiber-Optic Cable for Domestic Communications

90FE0302 Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 7, Jul 90 pp 5-6, 4

[Article by Xing Jiaxiang [6717 1367 6272]: "Model Numbers of Fiber-Optic Cables for Communications in China"]

[Text] As the fiber-optic communications industry advances, China has the capability of producing a variety of fiber-optic cables. This paper introduces the way model numbers are assigned to different cables.

The model number of a fiber-optic cable consists of a cable number and a specification number, separated by a dash, as specified in Appendix A of Chinese national standard GB7424-87, entitled "General Requirements for Fiber-Optic Cable for Communications."

A. Model Symbols

The model number of a fiber-optic cable consists of five parts, as shown in Table 1.

Table 1

I	II	III	IV	V
type	reinforce-ment	derived property	jacket	outer jacket

(1) type Symbols (I)

GY—outdoor fiber-optic cable for communications; GR—soft fiber-optic cable for communications; GJ—indoor fiber-optic cable for communications; GS—fiber-optic cable inside communications; GH—underwater fiber-optic cable for communications; GT—special fiber-optic cable for communications.

(2) Symbols for Reinforcement Structure (II)

none—metal reinforcement; F—non-metal reinforcement; H—heavy-duty non-metal reinforcement.

(3) Symbols for Derived Characteristics (III)

B—flat; Z—self-supporting; T—filled.

(4) Symbols for Protective Jacket (IV)

Y—polyethylene jacket; V—polyvinyl chloride (PVC) jacket; U—polyurethane jacket; A—aluminum/polyethylene bonded jacket; L—aluminum jacket; G—steel jacket; Q—lead jacket; S—steel/aluminum/polyethylene jacket.

(5) Symbols for Outer Jacket (V)

Per National Standard GB2952-82:

02—polyvinyl chloride; 03—polyethylene; 20—bare steel ribbon armor; 22—steel ribbon armor with PVC jacket; 23—steel ribbon armor with polyethylene jacket; 30—bare steel braid armor; 32—bare steel braid armor with PVC jacket; 33—bare steel braid armor with polyethylene jacket; 41—thick steel wire armor with fiber glass jacket; 241—steel ribbon/thick steel wire armor with fiber glass jacket.

B. Specification Symbols

The fiber-optic cable symbol is a combination of symbols for the optical fiber and the conductive wire.

1. Specification Symbols for Optical Fiber

The specification symbol for an optical fiber consists of five major parts, as shown in Table 2.

Table 2

I	II	III	IV	V
[No. of] fibers	type	major dimen-sions	operating wave-length/at-tenuation constant/ mode bandwidth	operating tempera-ture range

(1) Number of Fibers (I)

This is the number of effective fibers in the cable

(2) Symbols for Optical Fiber Type (II)

J—SiO_2 multimode graded [i.e. graded-index] T—SiO_2 multimode step-index (abrupt-change) fiber; Z—SiO_2 multimode quasi-step-index fiber; D—SiO_2 single-mode fiber; X—SiO_2 core plastic-clad fiber; S—plastic fiber.

(3) Major Dimensions of Fiber (III)

It is expressed by the value in microns of the core diameter/cladding diameter for a multimode fiber and by the value in microns of mode field diameter/cladding diameter for a single-mode fiber.

(4) Symbols for Fiber-Optic Transmission Characteristics (IV)

The transmission characteristics of the fiber are expressed in a three-element set symbols represented by a, bb and cc in parenthesis, where a is a one-digit number for operating wavelength: 1 indicates 850 nm range, 2 indicates 1300 nm in range and 3 indicates 1550 nm range.

bb, a two-digit number, is the attenuation constant, which represents the digit in front and the digit behind the decimal point of the attenuation constant (in dB/km). Table 3 shows the attenuation constants and symbols for multi-mode graded SiO_2 fibers. Table 4 shows the attenuation constants and symbols for SiO_2 single-mode fibers

Table 3

Symbol	Wavelength (nm)	Attenuation constant not greater than (dB/km)
125CC	850	2.5
130CC	850	3.0
135CC	850	3.5
140CC	850	4.0
208CC	1300	0.8
210CC	1300	1.0
215CC	1300	1.5
220CC	1300	2.0
230CC	1300	3.0

Table 4

Symbol	Wavelength (nm)	Attenuation Constant not greater than (dB/km)
204	1300	0.4
205	1300	0.5
206	1300	0.6
207	1300	0.7
208	1300	0.8
210	1300	1.0

CC is the symbol for mode bandwidth and is a two-digit number. The numbers correspond to the fourth and third digits (representing thousands and hundreds of MHz-km) of the mode bandwidth of the fiber. Table 5 shows the bandwidth of multimode graded SiO_2 fibers (converted to 1 km from the length of manufacture) and the corresponding symbols. This does not apply to single-mode fibers.

Table 5

Symbol	Wavelength (nm)	Mode bandwidth not less than (MHz-km)
1bb02	850	200
1bb05	850	500
1bb08	850	800
1bb10	850	1000
2bb02	1300	200
2bb05	1300	500
2bb08	1300	800
2bb10	1300	1000
2bb12	1300	1200

Note: the equation to convert mode bandwidth from manufactured length to 1 km is

$B_m = B_{ML}(L/1000)^{\Gamma}$ (MHz-km)

where B_{ML} is the bandwidth at manufactured length (MHz), L is manufactured length (m) and Γ is the bandwidth length index, which is set at 1 for the moment.

Example 1: The transmission characteristics symbol of a cable with multimode fibers operating in the 850-nm-wavelength region and with an attenuation constant not greater than 3.0 dB/km and a mode bandwidth not less than 200 MHz-km is (13002).

Example 2: The transmission characteristics symbol of a cable with single-mode optical fibers operating in the 1300-nm-length region and with an attenuation constant not greater than 0.8 dB/km is (208).

If the same cable is suitable for more than one wavelength and has different transmission characteristics, specification symbols for all wavelengths are listed by separating them with "/", such as (13008/20808).

(5) Symbols for Suitable Temperature Range (V)

This is usually divided into four classes, as shown in Table 6.

Table 6

Symbol	Suitable temperature range (°C)
A	-40 to +40
B	-30 to +50
C	-20 to +60
D	-5 to +60

2. Specification Symbols for Conductive Electrical Wire

The specifications for the conductive core should be consistent with the specification requirements listed in the electrical cable standard. If aluminum wire is used, an "L" should be added to the end of the wire diameter specification. Example: 4 x 4 x 0.9L represents 4 sets of 4-conductor 0.9-mm-diameter aluminum wires.

C. Example

For an outdoor cable for communications that has heavy-duty metal reinforcement, is self-supportive, has an aluminum jacket and polyethylene outer jacket, with 12 SiO_2 multi-mode graded fibers with a core diameter to cladding diameter ratio of 50/125μm, with 5 sets of 4-conductor 0.9-mm-diameter cooper wires to supply power to a remote site and for monitoring, with a fiber attenuation constant not greater than 1.0 dB/km, with an operating wavelength of 1300 nm and a mode bandwidth not less than 800 MHz-km, suitable for use at -20 to +60 °C, the model number is GYGZL03-12J50/125(21008)C+5x4x0.9.

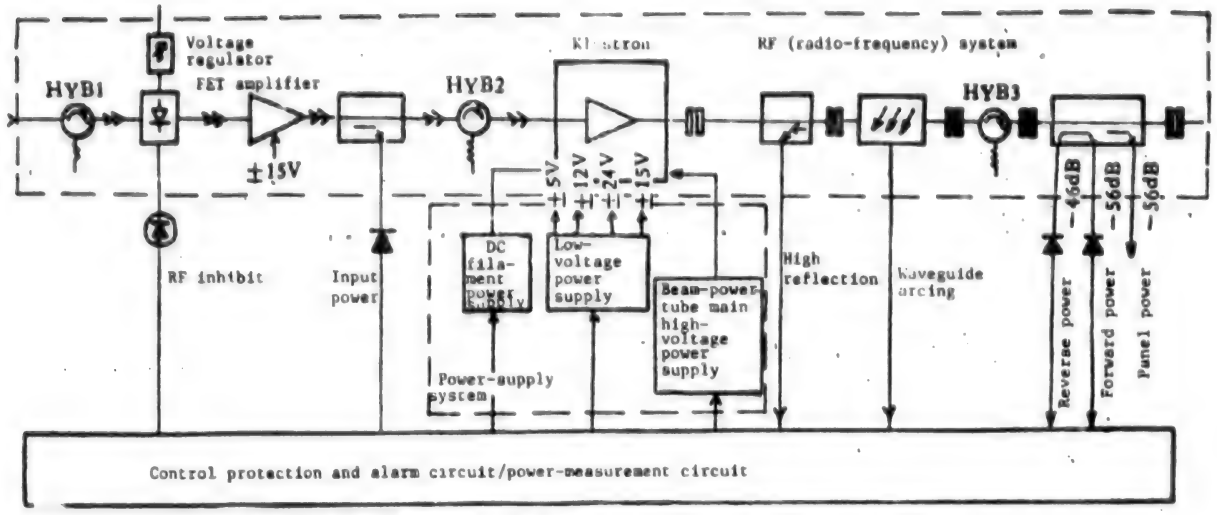


Figure 1. Block Diagram of WSF 132 Klystron High-Power Amplifier

Two More Fiber-Optic Communications Lines Described

91P60009A Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 9, Sep 90 p 46

[Two unsigned, untitled short news reports]

[Text] Construction began on the Jingzhou-to-Yichang [Hubei Province] 34Mb/s [DS3] single-mode overhead fiber-optic communications project on 5 July, and is projected to be completed by year's end. This project extends China's first super-long overhead fiber-optic cable project another 117.75 kilometers to the West, and will add 480 [simultaneous] direct long-distance voice circuits between Jingzhou and the Yichang area.

The Lanzhou-to-Wuwei [Gansu Province] fiber-optic-cable communications project recently passed initial trial operation. This project constitutes the nation's first long-distance directly buried fiber-optic-cable communications trunkline using domestically made 140MB/s [DS4, 1920 simultaneous voice circuits] equipment throughout. Its trial operation is of major importance to the development of domestic fiber-optic communications. Total length of the line is 295 kilometers. If 34Mb/s [DS3, 480 simultaneous voice circuits] optical communications equipment is added, telephone, telegraph, data, FAX and other transmission services can be opened up.

WSF 132 1kW/3kW Klystron High-Power Amplifier for Satcom Earth Station

90FE0318A Shanghai DIANXIN KUAIBAO [TELECOMMUNICATIONS INFORMATION] in Chinese No 6, Jun 90 pp 2-4

[Article by Yang De [2799 1795] and Pan Xuewei [3382 1331 0251]]

[Text]

1. Introduction

In 1978, the No 1 Research Institute of the Ministry of Posts and Telecommunications (MPT) developed the SGF-1 3kW klystron high-power amplifier. Over the past dozen years, this product has been used by most major satellite earth stations around the country to carry out many important international and domestic communications tasks. In an effort to further improve the quality of this type of product, we have developed a new product—the WSF 132 1kW/3kW general-purpose klystron high-power amplifier—based on the results of an extensive user survey.

The WSF 132 is superior to the original product in terms of reliability, stability and maintainability; it also has a longer design life, an improved structure and greater operating flexibility. It is compatible with the operation of N:1 systems.

2. Block Diagram and Technical Specifications

The block diagram of the WSF 132 klystron high-power amplifier is shown in Figure 1.

The key technical specifications are as follows:

frequency range	5925-6425 MHz
1-dB bandwidth	40 MHz
output power	3 kW
output-power tuning range	0-20-dB continuous tuning
gain	[greater than] 75 dB
gain/frequency response	0.4 dB_{p-p} (F_0 ± 14.4 MHz)
	1 dB_{p-p} (F_0 ± 20.0 MHz)
gain/slope	± 0.02 dB/MHz (F_0 ± 6 MHz)

	± 0.04 dB/MHz (F_0 ± 14.4 MHz)
harmonic output (without filter)	-35 dBc (2nd order)
	-50 dBc (3rd order)
AM/PM conversion	4°/dB(max) (rated power minus 3 dB)
noise and stray	-70 dBW/4kHz (max)
	(5925-6425 MHz)
	-135 dBW/4kHz (max)
	(3.7-4.2 GHz)
	-110 dBW/1MHz (max)
	(4.2-4.0 GHz)
intermodulation product	-24 dBc (rated power minus 7 dB, two equal-amplitude carriers)
input standing-wave ratio	1.25:1
output standing-wave ratio	1.25:1
load standing-wave ratio	2.0:1
residual amplitude modulation	[less than or equal to] -40 dBc (F_0 [less than] 4 kHz)
	[less than or equal to] -20(1+lg F_0) dBc
	(4 kHz [less than or equal to] F_0 [less than or equal to] 500 kHz)
	[less than or equal to] -80 dBc (F_0 [greater than] 500 kHz)
residual frequency modulation	-60 dBc (less than 4 MHz_{p-p} frequency bias in any 5-MHz band)
group delay	linear ± 0.25 ns/MHz
	parabolic 0.05 nx/MHz^2
	fluctuating 2 ns_{p-p}
audible noise	[less than] 70 dB
operating environment	temperature 5-40°C
	humidity 5% - 85%

3. Main Features of the WSF 132 High-Power Amplifier

3.1 RF System

The main amplifier uses an improved klystron developed by the No 1 Research Institute of MPT. By incorporating new materials, the technically and structurally improved klystron has significantly enhanced performance in terms of saturated output power, instantaneous bandwidth, gain, stability and design life.

The pre-amplifier is a field-effect [FET] amplifier which raises the overall system gain to greater than 75 dB. The voltage regulator uses a high-performance PIN electron attenuator. It can also be used to suppress RF excitation in case electric arcs occur in the waveguide.

In the RF system, a directional coupler capable of detecting microwave signals is used to indicate the voltage level and to provide protection for the input voltage, the output forward power and the output reflected power.

3.2 Control, Protection and Power-Measurement Circuits

The control, protection and power-measurement circuits have incorporated designs of "integration and digitization"; they use CMOS [complementary metal-oxide-semiconductor] circuits with strong interference-rejection capability and the new-generation IC operational amplifiers. They have also incorporated good isolation measures to reduce the size and to achieve high reliability and performance. The power-measurement circuit uses a board-mounted display unit which gives direct readings of RF power (W or dBW) in the range of 30-3,000W.

3.2.1 The control and protection circuit performs the following functions:

1) It controls the low voltage, the filament voltage, the blower and the high voltage so they operate according to design procedure.

2) It controls the start-up and shut-down procedures. The start-up procedure is as follows: switch on the main power supply——switch on the low-voltage——turn on low-voltage power to the entire system, turn on the blower for cooling the field-effect amplifiers——delay 5 minutes——turn on high voltage.

The shut-down procedure is as follows: switch off high-voltage——switch off filament voltage——the blower automatically stays on for 2.5 minutes——switch off low-voltage——turn off main power supply.

3) The system has an automatic high-voltage procedure.

4) The system has alarm and protection devices for the following parameters: the klystron temperature, the blower rate, the filament, the gate interlock, the klystron current, the high load reflection, the beam collector current, the waveguide electric arcs, the klystron reflection, and the high/low RF output.

5) It can perform the functions of simulation and tests for waveguide arcing and high load reflection.

6) It has quadruple alarm capability.

3.2.2 The power-measurement circuit performs the following functions:

1) It measures the forward output power and displays it in digital form over two different ranges: 30-300 W and 0.3-3 kW; the readings can also be converted to dBW.

2) The forward power detection unit has alarms for both high-voltage and low-voltage limits which can be preset in the range of 0-3.5 kW and displayed in digital form.

3) It can measure the magnitude of the reflected power and display it in digital form.

4) When the reflected power exceeds 120 W due to load mismatching, an alarm signal is transmitted.

5) When the klystron load capacity is exceeded due to mismatching between the klystron and the waveguide system while tuning the klystron, an alarm signal is also transmitted.

4. Power Supply System

4.1 High-Voltage Power Supply System

The high-voltage power supply system is a three-phase, 380-V AC system with a minimum output voltage of 5000 V and a maximum voltage of 8500 V; the maximum current is 1.2 A and the filtering level is 0.2%.

The system uses the new model-C transformer which can withstand a voltage level of 15 kV and whose temperature rise is less than 40°C at 8000 V/1.1A.

4.2 Filament Power-Supply System

By using a DC power supply, the system not only improves the amplitude modulation index, but also extends the life of the klystron.

4.3 Automatic Adjustment of High Voltage

By taking a voltage sample from a small three-phase transformer and comparing with a standard signal, a voltage error signal is generated; the error signal is used to control the turn direction of the motor which adjusts the operating voltage of the voltage regulator until the error signal vanishes. The accuracy of adjustment is 1%, which ensures that the system can operate under $\pm$10% voltage fluctuations in the network.

4.4 Low-Voltage Power Supply

The low-voltage power supply uses modern integrated circuits which not only reduce the size of the unit and improve its reliability, but also facilitate maintenance and repair of the unit.

5. Overall Structure and Air Cooling System

The structure of the container has been redesigned and its height has been reduced from 2 m to 1.8 m to allow installation of the back-up waveguide on top of the container.

The new design has incorporated technical and structural improvements which make the new system superior in terms of ease of operation, structural reliability, and appearance.

One of the problems with the original 3-kW high-power amplifier was the high noise level of the air cooling system. In the new design, we have developed a noise suppressor which reduces the audible noise level to 70 dB.

Concluding Remarks

The WSF 132 1kW/3kW klystron amplifier developed by this institute is one of the key components of a satellite earth station. In 1989, the amplifier was certified by the Research Institute of Post and Telecommunications Science; members of the certification committee were favorably impressed by its appearance, construction and its performance-to-cost ratio. In this article, we have presented a description of the WSF 132 klystron high-power amplifier, which we hope will provide the needed service for users around the country.

Performance Analysis of Indoor Wireless DS/SFH Hybrid SSMA Communications System With DPSK Modulation

906A0003A Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 11 No 3, May 90 pp 17-24 (MS Received 11 Jul 88)

[Article by Wang Jiangzhou [3769 3068 5297] and Wu Boxiu [0702 0130 0208] of Southeast University, Nanjing]

[Abstract] The paper analyzes the performance of noncoherent reception in hybrid direct-sequence/slow-frequency-hopped (DS/SFH) spread-spectrum multiple access (SSMA) communications systems operating through indoor wireless multipath and fading channels. The system employs frequency-diversity reception technology with differential-phaseshift keying (DPSK) modulation and predetection combining. The authors obtain approximations for the multiuser probability of the bit error rate by using a Gaussian approximation for multiple access and multipath interference.

Seven figures show a transmitter of the DS/SFH hybrid spread-spectrum system, a DS/SFH hybrid SSMA receiver adopting the predetection combining technique, the dehopper/despreader/demodulator circuits block diagram, and performances of DS/SFH hybrid indoor wireless SSMA communication systems.

References: 14 English.

Synchronization, Synchronous Performance of Pseudo-Random-Code Frequency-Domain Correlator

906A0003B Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 11 No 3, May 90 pp 25-31 (MS Received 26 Dec 88)

[Article by Feng Ziqiu [7458 1311 5941] and Yin Huadong [1438 5478 2767] of Suzhou University]

[Abstract] This research, funded by the Natural Science Foundation of the Jiangsu Provincial Education Commission, analyzes the fundamental principles and synchronizing method of frequency-domain correlation of a

pseudo-random code. With narrow-band noise, the synchronous performance of the pseudo-random code is calculated and analyzed; in addition, the correct synchronizing probability is derived. Three figures show block diagrams for executing pseudo-random-code synchronizing and for constructing the frequency-domain correlator from discrete SAW (surface acoustic wave) devices, as well as the distribution curve of synchronizing probability for a given signal-to-noise ratio. A table lists data for the correct synchronizing probability corresponding to the signal-to-noise ratio.

The final draft was completed on 20 September 1989.

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Highly Stabilized Waveguide Gunn Oscillator Using Dielectric Resonator

906A0003C Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 11 No 3, May 90 pp 53-57 (MS Received 28 Apr 87)

[Article by Chen Zhizhang [7115 1807 3764] and Shi Junming [4258 0193 2494] of Fuzhou University]

[Abstract] In the paper, a K_u-band waveguide Gunn oscillator of a novel structure stabilized by a dielectric resonator is developed. The resonator is highly stabilized in frequency; by selecting the proper temperature coefficient of the dielectric resonator, the frequency drift for an oscillator frequency of 10,909 GHz will be less than +/-250 kilohertz in the temperature range from -10°C to +60°C, and less than +/-60 kilohertz in the temperature range from 0°C to +60°C. The oscillator has been successfully employed as the first local-oscillator source in a 12 GHz satellite ground receiver. Eight figures show diagrams of the oscillator structure, an ellipsoid metal cavity with cylindrical dielectric, a cylindrical dielectric resonator placed in a rectangular waveguide, the equivalent circuit of the dielectric resonator, the structure and equivalent circuit of a frequency-stabilized cavity, the equivalent circuit of the oscillator, as well as measured performance curves of the oscillator.

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Deng Yanmou [6772 5888 5399], "Frequency Stability of Gunn Oscillator Varies With Environmental Temperature," GUTI WEIBO QINGBAO [INFORMATION ON SOLID STATE MICROWAVES], No 2, 1973, pp 39-46.

Also 8 English, 1 Japanese.

Analysis of MIS Coplanar Stripline for MMICs

906A0003D Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 11 No 3, May 90 pp 58-62, 31 (MS Received 4 Nov 87)

[Article by Lu Fan [7120 5400] and Li Sifan [2621 0843 5400] of Southeast University, Nanjing]

[Abstract] By applying a full-wave spectral-domain technique, the paper analyzes the propagation characteristics and characteristic impedance of a metal-insulator-semiconductor coplanar stripline (MISCS) in a gallium-arsenide monolithic microwave integrated circuit (MMIC). A set of calculated curves is given and the effect of the structural parameters on MISCS characteristics is studied. Some design criteria are given for low-attenuation slow-wave propagation. Since no published MISCS data are available, the authors use the following indirect method to check their results: the MIS coplanar waveguide (MISCPW) is analyzed by the same method as that used for analyzing MISCS. The results obtained are in good agreement with the findings published in related references. It shows that the technique used and analysis results in this paper are correct.

Eight figures show the coplanar stripline (CS) structure, a comparison between the theoretical calculations and the experimental results of coplanar waveguide (CPW), as well as CS parameters and features.

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Also 16 in English.

Investigation of Double-Heterodyne Phase-Locked Tracking for Coherent Fiber-Optic Communications

906A0003E Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 11 No 3, May 90 pp 89-91 (MS Received 1 Jul 88)

[Article by Tang Mingguang [0781 2494 0342] of the University of Electronic Science and Technology,

Chengdu, and Xiao Shilin [5135 4258 2651] of Guilin Research Institute of Optical Communications]

[Abstract] The paper presents a new scheme which stabilizes intermediate-frequency (IF) signals for coherent fiber-optic communications using double-heterodyne phase-locked tracking. The scheme makes the optical heterodyne IF stability higher by one magnitude over that using the conventional frequency negative feedback, in addition to providing a capability of free adjustment of the heterodyne IF frequency. The experimental system uses two 1.52-micron-wavelength He-Ne gas lasers as, respectively, the independent transmitter and the local oscillator. When the PZT [piezoelectric transducer] control voltage is within the range of 0-600 V, IF stability at the hundred-megahertz level is achieved. Frequency stability and reproducibility on the order of 10^{-9} are achieved. The double-heterodyne scheme with phase-locked tracking can greatly increase the optical heterodyne IF frequency; this may provide an easily executed means for the heterodyne detection of light-wave multichannel communications.

Two figures show a block diagram of an experimental system for double-heterodyne phase-locked tracking, and oscilloscope photographs of the optical and electrical heterodyne IF waveforms. One table lists data from a frequency-measurement record of the optical heterodyne IF.

References: 2 in English.

Update on Beijing Positron-Electron Collider

90FE0307B Beijing RENMIN RIBAO in Chinese 22 Jul 90 p 1

[Article by Jiang Hanzheng [5592 3211 4631] and Li Hongbin [2621 3126 0393]]

[Text] Beijing, 21 July (RENMIN RIBAO)—The Beijing positron-electron collider project today passed the state acceptance test. The acceptance committee members unanimously agreed that the overall performance of the collider is of a standard comparable to the world standard of the 1980's.

By completing this 240-million-yuan project and making it operational, China's high-energy accelerator design has skipped over the stage of building stationary-target accelerators of the 1950's, 1960's, and 1970's; it has directly reached the state-of-the-art collider technology of the 1980's. The acceptance committee believes that the collider has incorporated innovative design concepts which would place China at the frontier of today's high-energy physics research; also, the synchronized radiation light produced by the storage ring can be used in many research areas such as biology, medicine, chemistry and materials.

In October 1984, Comrade Deng Xiaoping personally broke ground for this new project; the overall installation was completed in November 1987, and operation of the positron-electron collider began in October 1988. According to expert sources, such an accelerated schedule is rare in the history of high-energy accelerator construction.

Ninety percent of the parts used in this highly sophisticated scientific project, which includes thousands of precision and complex components, were developed in China; for this reason, the cost of this collider is only half the cost of building a similar machine abroad.

Today, the High-Energy Research Institute has the capability to export accelerators, detectors, and synchronized radiation equipment; it also has the capability to develop a complete collider machine. In an effort to cooperate with other countries, it has accepted contracts from the United States, Brazil, and South Korea in joint efforts to develop equipment and technology for high-energy physics research. During the past 2 years, it has received a total of 3 million dollars from abroad.

Quark Research Near World Levels

90FE0307C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 30 May 90 p 1

[Article by Xi Geng [0823 2704]]

[Text] Shanghai, 28 May (KEJI RIBAO)—The quark is the most basic form of matter known to man. Today, it is the main topic of discussion among 100 Chinese and foreign physicists attending the International Physics Conference in Shanghai. The director of the Shanghai Atomic Nucleus Research Institute of the Chinese Academy of Sciences, Yang Fujia, said that in this particular field, Chinese scientists have already established dialogues with their foreign colleagues, indicating that quark research in China is now approaching world standards.

Professor Yang explains that quarks are the basic constituents of neutrons and protons, and the study of quark activities in a nucleus is a topic of great interest to Chinese and foreign physicists today. The implications and potential of quark research, which is a basic science that combines research in nucleus physics and particle physics, is difficult to assess. Before 1939, when scientists were engaged in the research of atomic nucleus, they did not fully appreciate its implications at that time. But when nuclear fusion was discovered in 1939, only 3 years had elapsed before the first nuclear reactor was developed, and atomic weapons appeared 6 years later. This was a good example of how a scientific discovery could have a totally unimagined impact on the human race.

Over the past 10 years, China has made a concerted effort to catch up with the world standard in quark research; it cultivated a generation of dedicated nuclear physicists and particle physicists, and has produced some notable accomplishments.

Large-Scale High-Flux Reactor Operates Safely for Over a Decade

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[Article by Wang Qing [3769 7230] and Yu Dongshen [0060 2639 3932]]

[Text] Beijing, 6 July (RENMIN RIBAO)—The high-flux reactor developed by the No 1 Research and Design Institute of the Ministry of Nuclear Industry has completed its first decade of safe operation since its installation in 1981. Specifically, it has completed 21 furnace loadings and has performed numerous research and production tasks.

This reactor has a maximum thermal power output of 125,000 kW; the reactor building has an area of 81,900 square meters and contains 50,900 pieces of equipment and instruments. It is ranked third largest in the world in terms of power output and size.

The primary application of the high-flux reactor is to perform radiation tests on nuclear fuel elements and reactor materials, and to produce isotopes for civilian use. Since its initial operation, more than 40 radiation tests on materials for nuclear power plants and fuel samples have been completed and more than 2,000 test samples have been analyzed and evaluated; a large amount of test data has also been generated for use in applied research, basic research, and engineering design for China's nuclear industry.

In the area of isotope production, it has produced 2,000 pieces of urgently needed cobalt-60 for medical use, more than 1,300 molybdenum-technetium generators, and more than 1,400 tin-indium generators. In addition, it has also produced 1.4 million curies of industrial cobalt-60 and more than 480 pieces of iridium-192 for use in non-destructive inspection.

Because of its unique capability to produce different types and proportions of isotopes, the high-flux reactor has also been used to develop the iridium-192 γ-ray inspection machine, the cobalt-60 industrial inspection machine, the thulium-170 series inspection cameras, the cobalt-60 tumor treatment machine, the cobalt-60 external radiation treatment machine and a number of gages for isotope measurement. These devices have been favorably received by scientists and users.

Located in the foothills of Emei mountain, this high-flux reactor is admired not only by the Chinese people but also by foreign visitors. More than 100 delegations of scholars and government officials from 16 different countries have visited the reactor; they called it the "Pride of the Chinese people."

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